YIMBY Generation – yes in my back yard! UK householders pioneering microgeneration heat

Other

YIMBY Generation – yes in my back yard!

UK householders pioneering microgeneration heat

solar thermal solar water heating systems use heat from the sun to work alongside conventional water heaters.

YIMBY = abbreviation for *yes in my back yard*: a person / people who have embraced microgeneration technologies in their homes.

ground source heat pumps uses a buried ground loop which transfers heat from the ground into a building to provide heating and, in some cases, to heat domestic hot water.

biomass often called 'bioenergy' or 'biofuels', biomass is produced from organic materials, either directly from plants or indirectly from industrial, commercial, domestic or agricultural products. It falls into two categories, woody and non-woody biomass. Biomass is a carbon neutral process that can also contribute to waste management.

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energy saving trust®

Authors of this report

Robin Roy, Professor of Design and Environment, The Open University
Dr Sally Caird, Research Fellow, Design Innovation Group, The Open University
Jennie Abelman, Market Research Manager, The Energy Saving Trust

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1. Introduction and recommendations

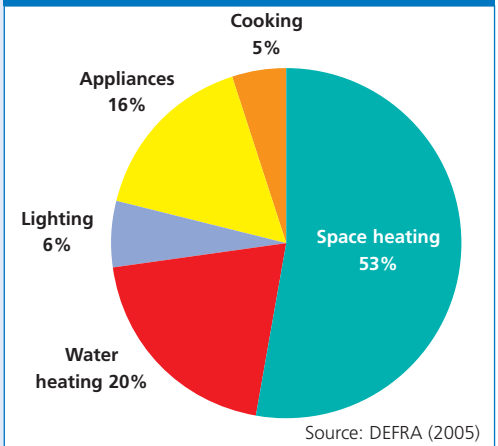
Why does microgeneration matter?

The 2008 Climate Change Bill sets demanding targets for CO_2 reduction in the UK. By 2020, emissions must be reduced by 26 to 32 per cent, with the Government committed to achieving 20 per cent of energy production from renewable resources. By 2050, the target is a 60 per cent reduction in CO_2 relative to 1990 levels. There is a chance that the 2050 target may rise yet further, to 80 per cent and beyond.

Households have a key role to play in reaching this demanding target. Domestic energy use accounts for 28 per cent of the UK's total carbon emissions. Around 75 per cent of these domestic emissions come from space and water heating. Microgeneration heat (defined here as the small-scale production of heat from a low carbon source) has an important role to play, because it can significantly reduce the 'carbon footprint' of space and water heating.

There are several technologies currently on the market: solar thermal water heating, heat pumps, biomass stoves and boilers. But adoption in the UK is very slow compared to other countries. Recent reports from the Parliamentary Trade and Industry Committee (2007) and the Energy Saving Trust (2007) highlighted the need to promote microgeneration heat technologies in order to hit UK carbon and renewables targets.

Figure 1: Domestic carbon emissions



Source: DEFRA (2005)

Introduction to this report

This report summarises the responses to a survey of over 900 households (the largest such UK study to date) who were considering or buying microgeneration heat technologies. It reveals what makes people buy or reject them – and provides insight into their experience of microgeneration.

It covers four technologies, all of which were eligible for grants under phase 1 of the Low Carbon Buildings Programme (LCBP):

- Solar thermal hot water
- Ground source heat pumps
- Wood-fuelled boilers
- Automatic pellet-fed biomass room heaters or stoves

The survey covered three types of households:

- Considerers – people who had considered buying
- Non-adopters – people who had considered but decided not to buy
- Adopters – those who had been awarded a LCBP grant to install

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This report concerns part of an Open University and Energy Saving Trust project that aims to evaluate carbon saving microgeneration heat technologies for UK households, funded under the UK Higher Education Innovation Fund's *Carbon Connections* programme. This report builds on previous Open University research on consumer adoption of household renewables (e.g. Herring, Caird and Roy, 2007) and summarises the results of a scoping study on what drives and inhibits consumer adoption. This study also forms the background for a detailed technical and user evaluation by the Energy Saving Trust and Open University of a selected microgeneration heat technology – heat pumps – in real UK domestic installations.

Key findings and recommendations

What makes people buy or reject microgeneration heat?

People are clear about why they have bought microgeneration heat technologies. They want to reduce their carbon emissions and fuel bills – but they also want the products themselves and are interested in the technology. They expect to get satisfaction from using low or zero carbon energy. Microgeneration 'adopters' are a distinct, committed group of pioneers who are unafraid to experiment.

What puts people off microgeneration is a mix of factors: financial (too costly, too long a payback); practical (e.g. not enough space); and perceptual (lack of confidence in the technology). Policy makers, manufacturers and marketers need to address these barriers if microgeneration is to spread beyond its early adopters.

Who are the 'early pioneers' and how could this niche market be expanded?

UK demand for microgeneration heat is currently confined mainly to a niche market of environmentally concerned, older, middle-class householders. One-fifth of these people have a job or hobby that relates to the environment or low carbon technology. This niche applies especially to ground source heat pumps, wood-fuelled boilers and biomass stoves; technologies which are best suited to big properties off the gas grid with room for, say, ground heat collectors or wood stores.

Solar hot water has a wider appeal, with one-third of adopters and half of considerers in the survey living in smaller, suburban or urban properties. This in part reflects the fact that the lower cost and smaller size of this technology makes it more widely suitable.

But microgeneration heat could reach well beyond this small group of adopters into an expanded niche market. The Energy Saving Trust has looked at the profile of grant applicants to the Low Carbon Buildings Programme and shown that 4.8 million homes (20 per cent of UK households) could be targeted. This affluent, well educated, middle aged and professional group (who are high fossil fuel users often off the gas grid) is similar to the 'adopters' in this research.

And although this survey does not cover them, microgeneration heat also has major potential in other markets: new build developments, housing associations and local authority homes.

Broadening the microgeneration market yet further

For microgeneration heat technologies to be accepted beyond current niche markets, however, the barriers to adoption must be addressed.

Dealing with up-front costs

It is clear from the research that there are price thresholds that act as a barrier to people buying. For example, reducing the installed price of solar hot water by a quarter to a third (rather than providing a grant worth around 10 per cent) would motivate many 'considerers' and 'non-adopters' in the survey into purchasing. Considerers are prepared to pay £2,500-£3,000 rather than the current average of £4,000. But only 25 per cent of considerers and 14 per cent of non adopters will pay £3,500 or more for a solar hot water system before any grant.

The price threshold for ground source heat pumps appears to be a maximum total cost of £11,000 (including modifications to the central heating system). This reflects the fact that just 26 per cent of considerers are prepared to pay

Financial measures to encourage purchase of microgeneration heat technologies (if all of equivalent value)	**914**
Base: All respondents	% choosing this measure
Annual reduction in Council Tax after installation	53
Government or local authority grant you had to apply for	39
Reduced price system from energy supplier	32
System installed free by an energy supplier and paid back via fuel bills	24
Low interest loan for full cost paid back over several years	18

over £10,000 for an installed system before grants.

For wood-fuelled boiler systems the threshold is £8,000 (excluding radiators) and for a biomass stove without a back boiler, about £3,000.

How could these cost barriers be dealt with? The table [above] shows the measures preferred by respondents, with council tax relief the most popular, and low-cost loans least favoured.

Boosting consumer confidence with independent advice and technology monitoring

Respondents cited difficulties finding installers and with the installation process, underlining the value of a "one-stop shop" for independent advice and information on energy saving and renewables - something that the Energy Saving Trust is planning to offer through its advice network.

Online information to assess a home's suitability for microgeneration would be welcomed by considerers and non-adopters. Individual installers skilled in the different technologies are also desired, as is more opportunity to see working systems in action.

Householders would welcome *Which*?-style independent tests showing how different microgeneration equipment performs. The Energy Saving Trust, in partnership with Government and industry stakeholders, is currently undertaking independent monitoring of micro-wind turbines and will shortly be launching independent field trials of heat pumps in collaboration with Carbon Connections, the Open University, Government and industry stakeholders. These field trials will be expanded to other technologies in the future.

Making systems compatible with more homes

Whilst solar hot water systems suit any property with south-oriented roof and space for a bigger water cylinder, ground source and biomass systems generally need more land and space than many homes have. While there will always be some properties that will never suit microgeneration heat, improving the technology will help widen its appeal. For heat pumps, using boreholes (which need less space) and designing highly efficient air source heat pumps (which need no ground loop) would broaden their potential. And smaller wood boilers and biomass stoves using local pellet fuel suppliers would encourage wider uptake.

Improving usability

Over three-quarters of respondents in the survey say their system performs satisfactorily and over 90 per cent get considerable pleasure from using it. Yet only 46 per cent say their bills have reduced as much as they expected. They would like more guidance on how to operate the system efficiently, as well as more user-friendly controls and feedback from their systems. These are particularly important to encourage the less 'technical' user.

Developing regulations

Respondents to the survey supported CERT-type obligations on energy suppliers to subsidise microgeneration systems as well as including them in building regulations. The concept of 'carbon rationing', however, was much less popular.

Recognising indirect benefits

Buying microgeneration technology usually results in additional indirect energy saving behaviour by the householder, such as the adoption of additional energy saving measures. Recognition of this would make subsidising the systems more worthwhile.

Problems experienced by users of microgeneration heat systems	**167**
Base – Adopters with an installed microgeneration system	% mentioning this problem
Uncertain how best to operate the system and its controls to make most efficient use of the fuel or energy	37
Difficulties understanding the system's controls	28
Unreliability of system e.g. component breakdown, leaks	17
System provides less than expected of heating and/or hot water requirements	12

Regulations that would encourage householders to install microgeneration heat technologies	**920**
Base: All respondents	% who agree
An obligation on gas and electricity suppliers to offer subsidised low carbon energy systems (like the current subsidised insulation schemes)	80
Building Regulations, or local planning rules, that require householders to install low carbon energy systems when undertaking major refurbishments, extensions or conversions to their home	69
A carbon rationing scheme (e.g. in which each citizen is given an equal carbon ration and can buy and sell unused rations)	35

2. Who are the microgeneration pioneers?

Microgeneration heat in the UK is largely confined to a niche market of environmentally concerned, older, middle-class householders who tend to live in larger rural properties off the gas grid. One quarter are retired, but from professional backgrounds. This applies to purchases of ground source and wood/biomass systems in particular: solar hot water extends to smaller urban and suburban properties.

Despite their backgrounds these pioneer households are not particularly affluent: just a quarter are in the top 25 per cent income bracket (with total pre-tax income over £60,000/year). They are, however, both energy and environmentally conscious: one in five is actively involved in environmental pressure groups and half actively try to cut air travel.

Many have used the opportunity of building or refurbishing a home to install microgeneration technologies. Half of these adopters are off the mains gas network and almost a third use oil for heating. Open responses showed that their decision to install was heavily influenced by oil price rises and threatened shortages in the winter of 2006.

Who adopts microgeneration heat technologies?	**546**
Base: Adopters	% Adopters
Two person households (adults aged 18+) with no children normally resident	46
Households with 1-3 children < 18 years	34
Main householder aged 45+	71
Main householder retired	25
Total annual household income (of all earners, before tax) <£60,000	63
Total annual household income (of all earners, before tax) >£60,000	28
Professional or senior managerial occupations	69
Actively involved with a pressure group, charity or political party to address environmental issues	20
Make a conscious effort to take fewer non-work flights	49

Where are microgeneration heat technologies installed?	546
Base: Adopters	% Adopters
Live in detached house or bungalow	73
Live in 4+ bedroom house	62
Live in house built before 1919	38
Live in new-build house built post 2006	10
With a medium or large garden or land (over 300m^2)	65
Live in rural location	65
Live in suburban location	25
Live in South East or South West England	51
Main heating fuel displaced: Mains gas	42
Oil	29
Electricity (on and off – peak)	8
Other fuels (coal, wood, Calor gas, etc.)	19

3. What makes people buy microgeneration heat?

Our survey identified three main drivers:

- Environmental – to reduce CO_2 emissions: *"just to do my bit for the planet and my kids"*
- Financial – to save money on fuel bills: *"a desire to be energy-independent, given rising fuel prices"*
- Desire – the anticipated pleasure of owning and using low- or zero-carbon technology: *"I want it."*

As these responses show, pioneering adopters are concerned about climate change, want to save money and also enjoy using microgeneration technologies.

Nearly a quarter are taking advantage of a new build or refurbishment to install microgeneration technologies.

Survey respondents want to make a difference:

- *'Ten years left to act before tipping point to irrevocable destruction of world. I want to help and to publicise urgent need'*

What drives people to seriously consider or adopt microgeneration heat technologies?	**859**
Base: Considerers and adopters	**%**
To reduce carbon dioxide emissions	75
To save money on fuel bills	72
I wanted to use low carbon energy and will get pleasure from doing so	61
Allows me to visibly demonstrate my environmental commitment	34
The low carbon technology forms part of a heating system replacement or upgrade	23
Related to my job, hobby or interests in the environment/ low carbon technologies	21
Being innovative, a pioneer in using low carbon energy technology	21
The low carbon technology forms part of other home improvements e.g. home extension; loft conversion, new build	20
Had funds available to help purchase the system	20
Had confidence in the performance and reliability of this technology	19
Recommended by friends, relatives or neighbours who have adopted the technology	6
Known manufacturers or brands for the equipment	4
Recommended by installer(s) or other energy specialists	3

'Obligation, as one of the prolific consumer generation, to recognise the damage it has caused and take some pain by making some contribution to a different future for the following generations'

- *'Felt it was time to do something to help mitigate the effect of our presence on the planet'*
- *'My wife and I understand and accept the serious implications of climate change and we are anxious to do all that we can to help alleviate the problem'*
- *'To save money and do my part to help stop global warming'*
- *'Satisfaction in designing and installing my own system'*

'I would like to help the environment and, as a physicist, I have an interest in low carbon technology systems.'

4. The route to microgeneration: how people choose – and what puts them off

Clear information is essential if people are to adopt microgeneration. As we see on page 15, uncertainty – about performance and payback – is a key barrier to adoption. People use the internet, manufacturers' literature or take advice from friends or installers. But they all have difficulty finding impartial, informed advice.

People often review more than one technology before choosing to buy the one that suits them best. This process is made difficult by the fact that installers tend to specialise in specific technologies.

On the whole, householders choose the least risky, cheapest and best established option – and they look for what is most compatible with their property. For these reasons, solar hot water is the most popular at present.

Sources of information and advice	**314**
Base: Considerers	**%**
Looked on the internet	91
Obtained literature about low carbon energy systems	52
Talked to family, friends or neighbours	38
Contacted installer(s) of low carbon energy systems	27
Visited retailers e.g. B&Q	24
Contacted architect/house builder/energy specialist	12
Home visit from installer	11
Contacted local council	10

Reasons for choice of technology	**545**
Base: Adopters	**%**
Less risky, better established technology	40
More compatible with my existing buildings and/or heating/hot water systems	37
As a result of the online and other information available	26
Lower initial cost	25
Faster financial payback than other low carbon energy technologies	25
Recommended by installers or other energy specialists	17
Less visual impact	12
Personal recommendations (e.g. by friends, relatives or neighbours)	10
Didn't consider any other technology	9

Choosing an installer

Householders typically choose installers who come across as being knowledgeable, trustworthy and reliable, and preferably local. They see accreditation as important, but open comments from respondents show that few schemes are currently available. Installers visit the customer two to three times on average and provide an average of two quotes.

The influence of grants

Grants are a major factor in the buying decision for microgeneration heat and it is often installers who draw them to customers' attention. Most 'non-adopters' cited the low level of the grant (covering typically 10-15 per cent of the price) as a reason for not buying. And although 70 per cent of people who took up LCBP grants cited it as a factor in their reason to buy, many downplayed its importance in retrospect and most criticised it for being too small:

- *'Not generous enough to be decisive'*
- *'To make a real impact, the grant should be increased'*

Installer visits and quotations	**546**
Base: Adopters	%
1 home visit	23
2 home visits	29
3 home visits	22
4+ home visits	22
1 quotation	33
2 quotations	30
3 quotations	27
4+ quotations	9

Reasons for choice of installer	**546**
Base: Adopters	%
Installer gave impression that s/he was knowledgeable, trustworthy, reliable	49
Because it was a local firm	32
Personal recommendation	21
Informative website	19
Recommendation by Council/local authority	9
Installer gave lowest price	6

Nearly half of the pioneers said they would have bought without a grant. But this attitude is unlikely to apply to a broader market.

What puts people off

Cost, lack of confidence in the technology and compatibility problems are the three main factors that put people off microgeneration heat.

Financial concerns include the high purchase price, worries about payback times and the low level of grants. And 56 per cent of non-adopters think there are better ways to cut carbon emissions, like installing insulation. Non-adopters also lack confidence in the systems' reliability and performance and are put off by the modifications needed to install the technologies into their homes.

Role of Low Carbon Buildings Programme grants	546
Base: Adopters	%
Importance of LCBP grant in your decision to purchase	24% very important 46% fairly important 25% not very important 5% not at all important
Would purchase without LCBP grant	44% probably 42% possibly 13% unlikely

Note: At the time of the surveys (mid 2007), the maximum LCBP grants available were:
Solar thermal - £400 or 30% of the eligible costs, whichever lower, Ground source heat pump – £1,200 or 30% of the eligible costs, whichever lower, Biomass pellet stove – £600 or 20% of the eligible costs, whichever lower, Wood fuelled boiler – £1,500 or 30% of the eligible costs, whichever lower

How important were the following issues in deciding against installing your preferred technology?	134
Base: Non-adopters	% saying very or fairly important
Purchase price	86
Payback is uncertain or long	68
Grant only covers 10-20% of purchase price	60
Performance & reliability uncertainties	58
More cost effective ways to reduce my carbon emissions	56
Possible major modifications to heating system	54
Difficulty finding space or suitable location	50
Time and effort required to investigate & install	47
Uncertainties on energy/$C0_2$ system will save	42
Won't provide all heating/hot water requirements	42
Difficulties getting grant	40
Difficulties finding suitable installer	26
Unlikely to add to, or may reduce, property value	23
Unattractive visual appearance	22
Installer quotes & visits required	22

5. Solar hot water - reasons for buying or rejecting; and experience of use

Solar hot water is the UK's most popular microgeneration heat technology. It is seen as less risky and more affordable, with a faster payback than heat pump or biomass options. It is also the easiest to connect to existing systems.

Over half of the systems installed under the LCBP use evacuated tubes. Typically they are linked to a single hot water tank with a 4m^2 collector facing south. (This collector area provides a reasonable amount of hot water in winter and not too much in summer for an average-sized UK property. Less efficient flat-plate systems, which account for a third of LCBP installations, may need a larger area.)

'The display of tank temperature has become another TV channel'

- *'It is fascinating to see what is happening'*
- *'Take baths on sunny afternoons! Or make any other use of hot water early in the day'*
- *'We wash up by hand in summer when water temperature from solar radiation is higher'*
- *'We have economised in hot water usage early in the day'*

'Teenagers bath more often, much more hot water available'

- *'It is a bit of a game to see how little electricity/water I can use!'*

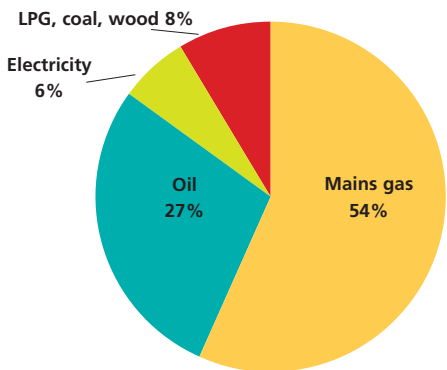
What types of homes install solar thermal technology?

What types of home install solar thermal technology?	413
Base: Solar thermal adopters	%
Detached properties	68
Semi-detached	19
4+ bedrooms	59
3 bedrooms	34
Built before 1919	33
Newbuild properties	5
Rural areas	56
Suburban locations	31

User experience

Whilst most people are delighted with their system, only 47 per cent say that reductions in fuel bills are as much as they expected. Solar hot water is an appreciated feature in homes. It leads to energy no longer being taken for granted – and it makes people change their behaviours to make best use of solar-heated water.

Figure 2: What heating fuel do they use



There are some hitches, though. Few realised that solar-heated water cannot be used in 'cold fill' washing machines and dishwashers, a problem cited by half of all adopters. Equipment available in Germany and elsewhere to deal with this problem is not supplied by UK installers. Comments also revealed that a few adopters only realised after installation that solar heated water was incompatible with electric showers. Better information and advice would help to get round these issues.

Why people reject solar thermal

How important were the following issues in deciding against purchasing solar thermal hot water?	60
Base: Non-adopters	% saying very or fairly important
Purchase price of £3000 - £4500	87
Payback on the investment is uncertain or long	75
Existing grant(s) typically cover only about 10-20% of the purchase price	65
There are more cost-effective ways of reducing my carbon emissions (e.g. better insulation, changing behaviour)	58
Uncertainty about performance and reliability of the technology	57
Could require major modifications to my existing heating, hot water or electrical systems	55
Difficulties getting a grant (e.g. LCBP grant)	48
The system would not provide all of my household's heating and/or hot water demand	42
The time and effort involved in investigating and installing	42
Difficulties finding space/suitable location for the solar panels or water tanks	38
Uncertainty about how much energy/CO_2 the system will save	33
The system is not likely to add to, or may reduce, property value/saleability	32
One or more installer visits and quotes required to find out suitability and cost of system	24
Difficulty in finding a suitable installer	22
Unattractive visual appearance of equipment	20

Solar thermal hot water improvements wanted by adopters	413
Base: Solar Thermal Adopters	%
Systems that provide home heating as well as hot water	57
System that gives user feedback on money and energy saved	48
Packaged systems e.g. solar water heating plus condensing boiler	30
Larger capacity water storage tank(s)	13

For each 'pioneer' household, there are many that reject solar thermal technology. The reasons they cite are the same as those for microgeneration heat as a whole: cost, low grants, uncertainty over performance and incompatibility with their property. Also, many are looking for complete microgeneration option and solar hot water only provides a partial solution.

- *"The price says it all. Payback is extremely long term and so shelling out so much money is not worth the investment.'*

"It is very difficult to find out what is the best system and who is a reputable installer.'

Ideas for improvement

Adopters would like thermal technology solar to deliver both heating and hot water. They may not realise that such systems are available, but are larger and cost a great deal more. Users also want controls that give them better information on how much money and energy they are saving.

6. Ground Source Heat Pumps

Although widely adopted in the USA, Sweden, Germany and Switzerland, domestic ground source heat pumps are not common in the UK, mainly due to different policy, regulatory regimes and energy costs, with only 1,000 installations in 2005/6. Despite this, they are the second most frequently considered low carbon heat technology in our surveys.

Most adopted ground source heat pumps in the UK use a horizontal trench for the ground loop (79 per cent) with only 13 per cent using the more expensive boreholes. Most provide heating and hot water and over half are connected to underfloor heating systems. Few provide cooling as well as heating, but indications are this may be changing. Systems have a maximum output of between 8-14kW, similar to a gas boiler.

Ground source heat pumps are more likely to be installed in 'retrofits' and new build homes than solar hot water systems.

What types of households install ground source heat pumps?	89
Base: Adopters ground source heat pumps	%
Two-person household	80
Professional or senior managerial	74
Retired	21
Houses	
Detached	90
4+bedrooms	80
Built before 1919	46
New build	36
With large gardens or >1,000m^2 of land	57
Rural locations	91
Off the gas grid	89
With mains gas	6
Previously used oil for heating	33

Reasons for choice of ground source heat pump system (rather than an alternative microgeneration heat technology)	**89**
Base: Adopters ground source heat pump	%
More compatible with existing buildings and/or heating/hot water systems	30
As a result of the online and other information available	29
Less risky, better established technology	26
Less visual impact	22
Faster financial payback	20
Recommended by installer(s) or other energy specialists	15
Personal recommendations (e.g. by friends, relatives or neighbours)	4
More cost-effective/affordable	8
Didn't consider any other technology	7

Why people reject ground source heat pumps

Few people who are interested in microgeneration even consider ground source heat pumps. This is because there are many barriers to overcome. It is expensive and people worry about its performance and reliability and how it will disrupt their property. And they are not sure whether it is a cost-effective way of reducing carbon.

Overcoming these hurdles and changing the image of ground source heat pumps will require better marketing, better support and a less disruptive installation process.

Even the adopters cite many of these problems, with 70 per cent complaining of disruption to their gardens and half having difficulty finding somewhere to install the equipment. A typical heat pump is the same size as a large refrigerator, may need a similar sized water tank and makes a fridge-type noise that requires shielding.

User experience

Nearly 90 per cent of adopters are very happy with their ground source heat pump system and get pleasure from using it. The systems have raised the energy awareness of 70 per cent, but only 40 per cent report the cost savings they expected.

Key problems centre around the complex controls designed to make the most efficient use of electricity and achieve comfortable room temperatures. Only 40 per cent find the controls easy to use and 20 per cent have great difficulty.

A quarter of users complained about the slow response times of the system and/or its inability to heat rooms to the required temperature. Over half would like better feedback from the system, for example on operating efficiency and energy saved.

How important were the following issues in deciding against purchasing a ground source heat pump?	43
Base: Non-adopters	% saying very or fairly important
Purchase price of £6,500 - £11,500	95
Payback on the investment is uncertain or long	70
Uncertainty about performance and reliability of the technology	63
Existing grant(s) typically cover only about 10-20% of the purchase price	58
The time and effort involved in investigating and installing	51
There are more cost-effective ways of reducing my carbon emissions (e.g. better insulation, changing behaviour)	51
Could require major modifications to my existing heating, hot water or electrical systems	51
Installing ground loops in trenches or borehole would involve great disruption to garden	51
Lack of sufficient land or suitable site for the underground heat exchanger pipes or ground loops	49
Uncertainty about how much energy/CO_2 the system will save	44
The system would not provide all of my household's heating and/or hot water demand	42
Difficulties getting a grant (e.g. LCBP grant)	28
Possibility of freezing or drying of soil from using the system	28
Difficulty in finding a suitable installer	28
It's not a renewable energy technology because it uses mains electricity	26
Unattractive visual appearance of equipment	16
The system is not likely to add to, or may reduce, property value/saleability	16
One or more installer visits and quotes required to find out suitability and cost of system	14

7. Wood-fuelled boilers

Using logs, woodchips or pellets to fuel central heating boilers is not common in the UK, where there were only 150 installations in 2005. In our survey manual-feed boilers are more commonly purchased (47 per cent) than automated pellet boilers (33 per cent).

What types of households install wood-fuelled boilers?

The profile of wood-fuelled boiler households is broadly similar to that for ground source heat pumps: environmentally conscious people in large rural properties, off the gas grid and previously heated by oil or electricity. But fewer adopters have a professional background; more are self employed or involved in farming, with many using their own source of wood.

How important were the following issues in deciding against purchase of a wood-fuelled boiler?	21
Base: Non-adopters	% saying fairly or very important
Purchase price	16 (76%)
Effort involved in sourcing fuel, refuelling, ash removal, etc.	15 (71%)
Could/would require major modifications to existing heating, hot water or electrical systems	14 (67%)
The time and effort involved in investigating, getting quotes, installing, etc.	13 (62%)
Lack of space/difficulties finding suitable location to install the boiler	13 (62%)
Existing grant(s) typically cover only about 10-20% of the purchase price	12 (57%)
Uncertainty about performance/reliability	12 (57%)
More cost-effective carbon reduction measures available	12 (57%)
Uncertainty about how much energy and/or carbon dioxide the system will save	11 (52%)
Uncertainty about obtaining supplies of good quality wood fuel	11 (52%)
Uncertainties about payback on the investment	10 (48%)

Why people reject wood-fuelled boilers

People are put off wood-fuelled boilers by the purchase price, the labour involved in running them and the property modifications required. Systems normally need a boiler house with space for a flue and good access to a store of wood chips, pellets or logs. Compact designs would be welcomed by most adopters.

User experience

Most people needed to make unexpected modifications to their buildings and experienced more disruption than they expected when the system was installed. However, over 90 per cent of adopters are happy with the system once it is installed and get much satisfaction from using it, despite the main problem of getting a good supply of wood fuel.

Whilst most people make more effort to save energy once the system is installed, over half heat rooms more than before, possibly because the heat output is harder to control. As with other microgeneration heat technologies, only half have achieved the reduction in bills they expected.

8. Biomass room heaters or stoves

Automated pellet-fed room heaters or stoves, whilst popular in Austria and Germany, are so rare in the UK that this survey provides only anecdotal evidence. The people who buy them give very similar reasons to those who have purchased wood-fuelled boilers or ground source heat pumps. And those who reject them have done so because of cost, the effort of finding fuel and running the stoves and concerns over lack of space, air pollution and reliability.

Over half of the adopters in the survey had bought stoves with a back boiler to heat hot water and/or radiators. All wanted a better infrastructure for obtaining fuel pellets – and open comments in the survey revealed a desire for less noisy stoves and more information on running costs and maintenance.

Most adopters have become more aware of their energy use as a result of using the stoves and also note they do not heat rooms to higher temperatures than before, which indicates that the stoves have good thermostatic controls.

'Mine is a Rika stove which uses pellets made from waste sawdust. It is so easy to use... it takes less than 5 minutes a day... It burns very, very efficiently... It looks very attractive... I love it'

9. Impact on householder behaviour

One of the most promising findings of this survey is that three-quarters of people using microgeneration heat say that they are more aware of their energy use – and make more effort to save energy than before. And perhaps unsurprisingly, they have adapted their behaviour to make the best use of the hot water and heat they now generate.

Buying microgeneration also goes hand-in-hand with other energy saving behaviour. Two-thirds of adopters have insulated their homes and use energy efficient appliances and five per cent have installed solar PV. The requirements of the LCBP have led to notable increases in home insulation, in some cases beyond the level needed to get a grant.

'I hate hearing the boiler firing up'

- *'We would certainly look to add more low carbon technology'*
- *'Made me think about additional measures'*
- *'Am making heroic efforts at insulation and adding extra radiators this summer as recommended'*

'We have examined every aspect of our home energy consumption and are aiming to reduce our carbon footprint by 50 – 60 per cent over the next 12 months with negligible sacrifice to quality of life, hopefully showing that most of the gloom and doom on TV is nonsense'

Changes in awareness and behaviour	n = 272
Base: Adopters with an installed microgeneration system	% agreeing
More aware of energy use than before	74
Make greater efforts to save energy than before	72
Have adapted our behaviour to make most efficient use of the technology	71

10. Summary and conclusions

Microgeneration heat technologies could make a significant contribution to achieving the UK's CO_2-reductions targets. However, there are a number of obstacles to surmount before these technologies can really start to have an impact.

The current UK consumer 'adopters' of microgeneration heat technologies are largely confined to a niche market of environmentally concerned, older, middle-class householders living mainly in off-gas areas and larger properties for which biomass and ground source heat pump technologies are currently appropriate and cost-effective. The solar thermal water heating market is wider, but still nascent. Like the other technologies, solar thermal is mainly bought by people wanting to use a low or zero carbon technology to reduce their emissions and fuel bills.

Although the adopters are generally highly satisfied with their purchase, for the microgeneration heat market to expand beyond the current consumer niche and reach its potential, the following issues need to be dealt with:

- Price thresholds – these should be reduced with a range of measures including better grants, subsidies from energy suppliers and council tax relief.
- Better advice – consumers want 'one-stop', independent, trustworthy advice that offers comparative information on the suitability, performance and payback of the different technologies and manufacturers systems.
- System compatibility – ground source heat pumps and biomass stoves and boilers do not generally suit smaller properties, and neither are all homes compatible with solar thermal systems. Technology and design improvements could address some of these compatibility issues.
- Better usability – more user-friendly and informative controls should make the technologies more appealing to a wider range of non-technical consumers.
- Lack of independent information on the reliability and performance of different microgeneration technologies - independent monitoring of different technologies would increase consumer confidence.

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Energy Saving Trust, 21 Dartmouth Street, London SW1H 9BP, Tel 0845 602 1425, www.energysavingtrust.org.uk